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**HOW TO MAKE AND USE A HOTBED AND
COLD FRAME.**

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In making a hotbed, the first step is to choose a good situation on the south side of a building, wall or close board fence where the cold winds from the north will be broken and all the sunshine possible will be obtained. After deciding on the site, the frame should be made. The simplest frame is one made out of two-inch planks. It should be so constructed that it may be raised, as this may be necessary if the plants get too close to the glass. The frame should be at least six inches higher at the back than at the front, in order that the rain will run off readily and that the plants get more sunshine. The sashes generally used are three by six feet. A hotbed may be made either above or below ground. If above ground, it may be made in any situation where the water is not likely to lie. The one below ground is usually preferable if it can be made where the land is high and well drained. To make the latter, the soil should be taken out to the depth of about eighteen inches and about three feet wider than the frame so that there will be room for banking. The banking is a very important part of the construction of a hotbed as the conservation of heat in the bed depends very much upon it. It will be readily seen that much labour will be saved by doing the necessary excavation for the frame in the autumn when there is no frost in the ground. Horse manure is the best to use in making the hotbed and it should be quite fresh, not cold and rotten, and not already heated. It should be piled near where the hotbed is to be and when it begins to heat it should be turned to make it of more uniform consistency. Five or six days after turning, it should be quite hot and is now ready for use. The bed is started from one end and the manure shaken in from a fork so that the long and short manure will be well mixed. When one layer is made it should be tramped well and then another layer started and so on, tramping each layer well until the manure is the depth required. The depth will depend on when the bed is made. If made early, the manure should be from two to two and a half feet in depth, but if made during the latter part of March when the weather is not very cold, about a foot of manure will suffice. After the manure has been put in, the frame should be placed on and then about four to six inches more manure put in and banked well around the sides of the frame, both inside and out. Outside, the manure should be banked to the top of the frame and from twelve to fifteen inches in width. The bed is now ready for the lights and the frame should be so constructed that they will fit snugly. Shelters made of one-inch lumber the same size as the sashes

are useful for covering them as they help to conserve the heat in cold weather. In two or three days the sash should be removed, the manure given a tramp all over, making it level where necessary, and then the soil put on. To get the best results the soil should be prepared the previous autumn and left in a pile over winter. It should be rich and of such a character that it will not bake. The soil should be from five to six inches in depth over the manure, and it is better to have it a little deep than too shallow. The soil when it is put in should come near the top of the frame at the lower side as the manure will sink considerably, and the nearer the plants are to the glass later on the stookier they will be. In five or six days the hotbed will be ready for the seed, but it is necessary to wait until the manure has cooled a little and the temperature has fallen to between 80 degrees Fahrenheit and 90 degrees Fahrenheit. During this time, when it is hottest, some of the heat may be allowed to escape by raising the sashes a little every day. One should not be in a hurry to sow the seed, as if the temperature is too high the results will not be satisfactory. When the bed has reached the right temperature the soil should be spaded over a couple of times and the surface levelled and made fine with the rake. The bed is now ready for sowing. The seed is usually sown in rows about four inches apart and about the same depth as outside. When the young plants come up the frame should be kept sufficiently aired by raising the back of the sash to prevent the plants from getting spindly or weakly, when they are apt to damp off. Care should be taken to prevent their being chilled or frozen. The soil must be watered when necessary, care being taken not to overdo this as the plants would then be likely to damp off. As soon as the plants are large enough they are pricked out into another sash or frame.

COLD FRAME.

A cold frame is much like a hotbed in appearance, but is without manure. It is used either for seeds or for growing plants taken from the hotbed before they can be set out in the open; or it may also be used by those who start plants in the house and who cannot get or do not wish to use manure.

A well protected place is chosen in the autumn and rich friable soil, six inches or more in depth, is put where the frame is to be placed. This soil and the ground about should be protected from frost by leaves or litter, which should not contain weed seeds. By thus mulching the soil in the autumn, when the time comes for planting in the spring there will be no frost in the ground about the frame. A frame should now be made with sides and ends of twelve inch boards, preferably two inches in thickness and placed on a slope so that the back part of the frame is six inches higher than the front. The frame is now placed over the soil. As hotbed sashes are six by three feet in size, the frame should be made to accommodate one or more of them. The soil is now well spaded and the frame protected from frost by earthing up outside or banking with manure. If the glass sash is over the top a few days before it is time to sow or set out the plants, the soil will be warmed up sufficiently. Plants should not be taken out of the house and planted in cold soil or they will be chilled and injured. The same attention in regard to watering and ventilation should be given to the cold frame as to the hotbed. By the use of a cold frame, plants will be well advanced when it is time to set them out and several weeks will be saved.

TOP-GRAFTING.

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Where there are trees which produce poor or unprofitable fruit they may be made to bear good fruit by top-grafting other varieties upon them. If it is desired to grow a good variety which when grown in the ordinary way proves a failure, on account of

root-killing or sunscalding, it is possible to grow it successfully by top-grafting. Varieties which ordinarily take a long time to come into bearing will fruit much sooner when top-grafted. These are some of the most important results which may be obtained by this method.

Up to the present time in Canada, top-grafting has usually been done on old or bearing trees which produced poor fruit, and as very satisfactory results have been obtained this practice will continue to be popular.

The work is done in the spring before growth begins, but it is possible to graft successfully even when the trees are coming into leaf, provided the scion is quite dormant, but the chances of success are much lessened if it is done late. As the shock to a large tree would be very great if all or nearly all the branches on which the leaves develop were cut off the first season, from three to four years should be devoted to removing the top of the tree. If, however, a large number of scions are inserted the top may be changed in less time, but as a rule it is not wise to do it in less than three years. Furthermore, a too severe pruning at one time will cause a large number of shoots to grow on the tree, and considerable labour will be involved in removing them if many trees are grafted. Cleft grafting is usually adopted in top-working trees, it being a simple and satisfactory method.

The branches to be grafted should not exceed an inch and a half or two inches in diameter. If they are larger it is so long before the stub heals over that disease may set in. It is possible, however, to graft larger branches by putting in more scions. The top-grafting of a large tree should be done with a view to having the new top as symmetrical as possible, and great care should be taken in selecting the branches to be grafted upon. After the branch is sawn off the stub is cleft by means of a mallet and strong knife to the depth of an inch and a half or two inches. It is held open to receive the scion by driving a wedge in it. Scions for use in top-grafting are cut from dormant wood which has been kept in good condition in the manner hereafter described. They should have about three strong buds and be cut wedge-shape at the base, one side, however, being a little thicker than the other. Two scions are now inserted in the cleft of the stub, with the wide side of the wedge on the outside, and thrust down until the lowest bud is almost on a line with the edge of the stub. The inner bark of both scion and stub should meet at some point, so that the union will take place readily, and this is more easily effected if the scion is given a slightly outward slope rather than a straight one. When the wedge has been withdrawn from the cleft the advantage of the wedge-shaped end of the scion thicker on one side will be apparent, as it will be much more tightly than if both sides were the same. If the scion is not a wedge-shape along there is something wrong in the way it has been cut or the stub has been cleft. The cut parts should now be covered with grafting wax to exclude the air and hold the scion in place. Cotton is also sometimes wrapped around the wax in order to more effectively hold the scion in place. If both of the scions grafted on a stub should grow, the weaker one should be removed after most of the surface of the stub has healed over.

It is often desirable to top-graft young trees, and this may be done very readily. The main branches are cut back to within a short distance of the trunk, and the scions grafted on, either by cleft or whip grafting. The closer the grafted part is to the trunk the better, as the tree will be stronger than if the union occurred further out on the limb, since the growth of graft and scion may not be equal. It is possible to cut off the whole top of the tree and graft successfully on the main trunk, when the tree is young, but unless one is sure that the union will be perfect and the top not outgrow the stock it is better not to run the risk of losing the tree. Furthermore, if the whole top is cut off there will be such a growth the first season that the scions are liable to get broken off. In top-grafting, a young tree that has been planted from three to five years, it is better to take two seasons to do the work, as the results will

be as a rule more satisfactory. In top-grafting it is usually desirable to begin with the central rather than the side branches.

It is necessary to examine the grafted trees from time to time during the summer and remove any young shoots from the stocks which are interfering with the scions. It is not wise, however, especially when the tree has been cut back severely for grafting, to remove all the shoots until the grafts have grown considerably and furnish a good leaf surface. McMahan, Haas and Hibernial apples make good stocks where the winters are very severe, and Tolman a good one elsewhere.

SCIONS.

As much of the success in grafting depends on the condition and quality of the scions, too much stress cannot be laid on the importance of having them of the best quality and in the best condition at the time of grafting.

Scions may be cut any time after the wood is well ripened in the autumn and before the buds begin to swell in the spring. The best time, however, is in the autumn, as they may then be kept in the condition desired. If they are cut in cold weather, in winter, the trees from which they are taken may be injured if large numbers are removed from them, as the bark is liable to split. There is less sap also in the scions at that time and thus the chance of their drying up is greater than if they were cut in the autumn. One cannot tell very well, either, in winter whether the young wood has been injured or not. Scions should be cut from healthy, bearing trees. The wood of old trees is liable to be diseased, and if diseased wood is used it is likely to produce a diseased tree when grafted. Scions should also be cut from the most productive trees. Occasionally, one or more trees of a variety will produce heavier crops than the others. If scions are taken from these trees, the probability is that a larger proportion of the trees grafted with them will prove more productive than they otherwise would. The scions should be cut from the wood of the current season's growth, as older wood is not satisfactory. The buds should be well developed and the wood thoroughly ripened. It is not wise to use the water-sprouts or young shoots which spring from the main branches or trunk for this purpose. They may not be thoroughly ripened, and it is also possible that sprouting propensities may be thus developed in the grafted trees. The entire season's growth may be cut off and packed away until required for grafting, when it should be cut into pieces from four to six inches in length each having three well developed buds.

Scions may be kept in good condition in moss, sawdust, sand or forest leaves. The last-named are found very satisfactory at Ottawa. These materials should be slightly moist, but not wet; the object being to keep the scions fresh and plump without there being any danger of rotting. They should be kept in a cool cellar which is not too dry, when they will remain dormant until ready for use.

GRAFTING WAX.

There are many kinds of grafting wax recommended, but it is unnecessary to enumerate them all. One of the cheapest and best is that known as 'Reliable Wax,' the recipe for which is as follows:—'Reliable Wax.'—Resin, four parts by weight; beeswax, two parts; tallow, one part. Melt together and pour into a pail of cold water. Then grease the hands and pull the wax until it is nearly white. One of the best waxes for either indoor or outdoor use. This should be heated before using if too hard.

A more pliable wax for outdoor use is made in the following proportions:—Resin, five parts by weight, beeswax, one part; boiled linseed oil, one and a quarter parts.

HOW TO TRANSPLANT A TREE OR SHRUB.

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When trees die after planting it is usually due to carelessness in transplanting. Some kinds of trees transplant much easier than others and some of those that are planted more commonly than others, such as the hard maple and American elm, are among the easiest to transplant, hence one is likely to become careless through success with these. Trees and shrubs should be dug as carefully as possible so as to retain a large proportion of the roots. The more roots there are the surer one is of getting the tree to live. The roots should not be allowed to become dry from the time of digging until the trees are in the ground again. They may be prevented from drying in transit by protecting them with wet moss or wet sacking. If the roots of evergreens, especially pines, become dry even for a short time the trees are almost sure to die. When planting, a hole should be dug large enough so that the roots may be spread out and not crowded or doubled up, and deep enough so that the tree or shrub will be from one to two inches deeper than it was in the woods or nursery. By planting a little deeper than it was before, provision will be made for a little heaving which often takes place the first winter, but planting too deep is almost as bad as planting too shallow. It is important to have the tree at least as deep as it was before digging and, as stated, best to have it a little deeper. The soil when thrown out of the hole should be put in two separate heaps, the surface or good soil in one and the sub-soil in another. If the soil is all poor, to get the best results some good soil should be brought to at least partially fill the hole. The tree is now placed in an upright position and the good soil is first thrown gently back about the roots of the tree. As it is important for the soil to come in close contact with the roots it should be trod firmly down with the foot, when thrown in. If there is not enough good soil available to fill the hole the poorer soil may be placed on top of the good. Manure should not be put in the hole with the soil as it may burn the roots and make the soil so loose that it will dry out easily. Better apply the manure to the surface of the ground in the autumn and dig in the shortest of it the following spring into the surface soil. After planting, the tree or shrub should be cut back well, the amount of heading in depending upon the amount of roots on the tree. If a large proportion of the roots are cut off a large proportion of the top should be removed, otherwise the large leaf surface will transpire so much moisture that the tree will dry up before the roots begin to take in more. This is why shade trees are cut back so severely when planted, but it is not necessary to reduce the trees to mere poles as is too frequently done, causing a bad crotch in the tree later on where the stub dies back and where rot is likely to get in.

Evergreens are not headed back like deciduous trees as it would disfigure them too much and they have usually a fair supply of roots.

Before leaving the tree the surface soil should be loosened again so as to leave a thin mulch of loose soil on top which will prevent the moisture evaporating as rapidly as it would do if the ground were left hard. The surface soil should be kept loose throughout the summer and the best growth will be obtained by keeping a circle of from two to three feet or more in diameter around the tree free of grass and weeds, where the soil will be kept loose and where the rain and air may find a ready entrance. If trees and shrubs are transplanted with care they should usually live. Early in the spring is the best time to transplant most kinds of trees and shrubs, evergreens included. Evergreens may be transplanted in summer, but greater precautions must be taken to do it successfully and it is not recommended. Both evergreens and deciduous trees may also be planted in the autumn successfully, but on the whole they do not do so well as if planted in the spring.

PROTECTION OF FRUIT TREES FROM MICE AND RABBITS, AND CARE OF INJURED TREES.

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Every year thousands of trees are injured in Canada by mice, and, in the newer districts, a large number by rabbits also. There could be nothing more discouraging to a fruit grower, or would-be fruit grower, than to see his orchard which he had cared for, perhaps, for five or six years, ruined by mice; and yet this frequently happens. All this could be prevented if the farmer or fruit grower would use the information available and protect his trees from mice. Some years there is less injury than others, and this fact leads to carelessness, and when a bad year comes the trees are unprotected.

While the depredations from mice and rabbits in winter vary from one year to another, depending on the scarcity or abundance of food, the number of mice which are in the vicinity and the character of the winter, the injury is always greatest when the orchard is in sod, and when there is rubbish lying about; hence the latter should be removed before the winter sets in. In most cases it is not necessary nor advisable to have the orchard in sod, particularly when the trees are young, although it is highly important to have a cover crop, which also may sometimes become a harbour for mice. As mice may be expected in greater or less numbers every winter, young trees should be regularly protected against their ravages. Mice usually begin working on the ground under the snow, and when they come to a tree they will begin to gnaw it if it is not protected. A small mound of soil from eight to twelve inches in height raised about the base of the tree will often prevent their injuring the tree, and even snow tramped about the tree has been quite effectual, but the cheapest and surest practice is to wrap the tree with ordinary building paper, the price of which is merely nominal. Tar paper is also effectual, but trees have been injured by using it, and it is well to guard against this when building paper will do as well. After the paper is wrapped around the tree and tied, a little earth should be put about the lower end to prevent the mice from beginning to work there, as if they get a start the paper will not stand in their way. It may be stated, however, that although two thousand young trees have been wrapped with building paper for several years at the experimental farm at Ottawa, there have been practically no instances where the mice have gnawed through the paper to get at the tree. The use of a wire protector, or one made of tin or galvanized iron, is economical in the end, as they are durable.

In the north, protection from sunscald is almost as important as protection from mice. At the Central Experimental Farm, wooden veneer protectors have been used for several years past for the standard trees, as these protect from mice and on account of being loose about the tree leave a good air space which appears to protect the tree from those sudden changes of temperature which seem to be the main cause of sunscald.

There are a number of washes and poisons recommended for the protection of fruit trees and the destruction of the mice and rabbits, but none of these are very satisfactory, as if the mice or rabbits are numerous the poison has not sufficient effect upon them to prevent injury altogether. The following method of poisoning has been found fairly successful.

Make a mixture of one part by weight of arsenic with three parts of corn meal. Nail two pieces of board each six feet long and six inches wide together so as to make a trough. Invert this near the trees to be protected and place about a tablespoonful of the poison on a shingle and put it near the middle of the run, renewing the poison as often as is necessary.

TREATMENT OF INJURED TREES.

If a tree is badly girdled by mice it usually dies. If as soon as the wound is noticed it is cleaned and covered with grafting wax or some paste, such as sulphur cowdung and clay, and wrapped with cloth to exclude air and prevent the wood from drying out, there is a possibility of saving the tree if the girdle is a small one, as the sap which rises through the wood will continue to do so, and returning through the inner bark in an elaborated condition will cause growth to be made all around the upper part of the wound, and if the latter be not too large there is a chance of its healing over. If, however, the wood becomes dry before the bandage is put on, the tree will almost certainly die, although it may continue to grow throughout the season. When the wax and bandage are applied the tree should be headed back considerably to lessen the amount of transpiration of moisture, as there will not be as much sap rise as if the tree were uninjured, and the wood will thus dry out sooner than if it were headed back. If the girdle is near the ground, in addition to covering the injured part with wax or cowdung and clay, it is advisable to mound up the soil about the tree to cover the wound and thus help to prevent the wood from drying out.

Girdled trees are frequently saved, and more surely saved than by the above method, by connecting the upper and lower edges of the girdle with scions, which are inserted about an inch apart all around the trunk. This is known as bridge grafting. The more scions that are used the quicker they will grow together and form a new trunk, but two or three scions successfully grafted on a small tree will carry enough sap to keep the tree alive. A slanting cut is made at each end of the wound in the uninjured wood in which the ends of the scions are to be inserted. Strong, plump scions of the previous season's growth—not necessarily from the same tree, nor even the same variety—cut a little longer than the distance between the slanting cuts, are made wedge-shaped at each end. They are made a little longer than the distance between the cuts in order that when inserting the ends into the cuts it will be necessary to bend them, and thus have them under pressure, which helps to keep them in position. After inserting, some of the inside bark of the stock should remain in contact with the inside bark of the scion, as it is here or at the cambium layer where union takes place. As soon as the scions are all placed the wound, especially about the ends of the scions where inserted in the stock, is covered with grafting wax. The ends are also at the same time bandaged with a piece of sacking around the trunk to aid in keeping the scions in place and to exclude the air. The tree should then be well headed back. The scions, if properly made and inserted, should soon unite with the stock and then carry the sap to the top of the tree.

Another method of bridging is to cut back the uninjured bark evenly all round the trunk and insert the wedge-shaped scions underneath the bark at the upper and lower ends of the wound. There are other methods also employed, such as using a scion bevelled at each end. Also, boring holes with an auger at each end in the uninjured bark and shaping the scion at each end so that it will fit into it.

One of the most satisfactory methods of utilizing the girdled tree is to cut it off close to the ground and insert a scion of some good variety. This graft should grow at least three feet in height the first season and make a nice young tree.

A tree may sometimes be saved when the girdling is well above the graft by cutting the tree back so as to remove all of the injured part. Under such conditions young trees will usually start fresh growth and the strongest shoot may be selected to form a new trunk and top for the tree.